



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/656,986	09/04/2003	Shin-Rung Lu	67,200-1145	9353

7590 05/30/2006

TUNG & ASSOCIATES

Suite 120

838 W. Long Lake Road

Bloomfield Hills, MI 48302

EXAMINER

DOTY, HEATHER ANNE

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 05/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/656,986

Applicant(s)

LU ET AL.

Examiner

Heather A. Doty

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18, 20 and 21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18, 20 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless – (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-10, 12-18, and 20-21 are rejected under 35 U.S.C. 102(e) as being anticipated by Subramanian et al. (U.S. 6,803,178).

Regarding claim 1, Subramanian et al. teaches a method for exposing a blanket photoresist layer (23 in Fig. 4A) to achieve optimal photoexposure conditions to produce different non-overlapping die patterns comprising:

providing a substrate (61 in Fig. 7) having formed thereover a photoresist layer; and exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns comprising a different pattern subjected to a different photoexposure condition (Figs. 4A-4D, 5A-5D; column 4, lines 18-column 5, line 50).

Regarding claim 6, Subramanian et al. teaches a method for exposing a photoresist layer (23 in Fig. 4A) to achieve optimal photoexposure conditions to produce different non-overlapping die patterns comprising:

providing a substrate (61 in Fig. 7) having formed thereover a photoresist layer; and exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks and two exposure conditions, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns comprising a different pattern density (Figs. 4A-4D, 5A-5D; column 4, lines 18-column 5, line 50).

Regarding claim 14, Subramanian et al. teaches a method for forming a patterned layer to achieve optimal photoexposure conditions to produce different non-overlapping die patterns comprising:

providing a substrate having formed thereover a target layer (21 in Fig. 4A) having formed thereover a photoresist layer (23 in Fig. 4A);

exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks, to form an exposed photoresist layer, each of said masks associated with one of said non-overlapping die sub-patterns, each of said non-overlapping die patterns comprising a different pattern density (Figs. 4A-4D, 5A-5D; column 4, lines 18-column 5, line 50);

developing the exposed photoresist layer to form a patterned photoresist layer (column 4, lines 58-67; column 5, lines 51-61); and

processing the target layer to form a processed target layer while employing the patterned photoresist layer as a mask (column 5, lines 1-10 and 62-67).

Regarding claims 2, 3, 7, 8, 15 and 16, Subramanian et al. teaches the method of claims 1, 6, and 14, and further teaches that the substrate is a semiconductor substrate or a ceramic (glass) substrate (column 6, lines 20-25).

Regarding claims 4, 5, 9, 10, 17, and 18, Subramanian et al. teaches the method of claims 1, 6, and 14, and further teaches that the photoresist layer is formed of a positive photoresist layer (Figs. 4A-4D; column 4, lines 18-20) or a negative photoresist layer (Figs. 5A-5D; column 5, lines 10-12).

Regarding claims 12, 13, and 20, Subramanian et al. teaches the method of claims 6 and 14, and further teaches that the photoexposure condition includes depth of focus and illumination (column 5, lines 29-50).

Regarding claim 21, Subramanian et al. teaches the method of claim 1, and further teaches that each of said non-overlapping die patterns comprises a different pattern density (Figs. 4A-4D, 5A-5D).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian et al. (U.S. 6,803,178) in view of Lai et al. (U.S. 6,187,486).

Regarding claim 11, Subramanian et al. teaches the method of claim 6 (note 35 U.S.C. 102(e) rejection above, but does not teach that the photoexposure condition includes exposure energy.

Lai et al. teaches that exposure energy is an exposure conditions that affects the linewidth of exposed photoresist (column 1, lines 48-67).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to use the method taught by Subramanian et al., and further use a minimum of two exposure conditions including exposure energy, in order to modify the linewidth of the photoresist patterns, as taught by Lai et al., for the various sub-pattern exposures.

Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. (U.S. 5,298,761) in view of Shibuya et al. (U.S. 5,851,707).

Regarding claims 1 and 3, Aoki et al. teaches a method for exposing a photoresist layer to achieve optimal photoexposure conditions to produce different non-overlapping die patterns comprising providing a ceramic (glass) substrate—further limited by claim 3—having formed thereover a photoresist layer (column 8, lines 40-44; column 16, lines 61-64); and exposing within a single die region within the photoresist layer a minimum of two non-overlapping die sub-patterns while employing a minimum of two masks, each of said masks associated with one of said non-overlapping die sub-patterns (column 8, lines 44-64; Fig. 1a shows the patterns, in a single die area, not overlapping), each of said non-overlapping die patterns comprising a different pattern (column 2, lines 5-10).

Aoki et al. does not teach that each of the non-overlapping die patterns is subjected to a different photoexposure condition.

Shibuya et al. teaches using a minimum of two photoexposure conditions, including illumination (further limited by claim 13; column 1, lines 36-39) to expose different die sub-patterns because some die sub-patterns require finer resolution than others (column 1, lines 24-40).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to use the method taught by Aoki et al. and further use a minimum of two exposure conditions, including illumination, as taught by Shibuya et al., in order to provide different sub-patterns with different levels of resolution, as expressly taught by Shibuya et al.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. (U.S. 5,298,761) in view of Shibuya et al. (U.S. 5,851,707) as applied to claim 1 above, and further in view of Eguchi (U.S. 6,220,714).

Regarding claim 2, Aoki et al. and Shibuya et al. together teach the method of claim 1 (note 35 U.S.C. 103(a) rejection above), but do not teach that the substrate is a semiconductor substrate.

However, Eguchi teaches that liquid crystal devices, such as the one taught by Aoki et al., can be made on glass or silicon substrates (column 16, lines 58-64).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to use the method taught by Aoki et al. and Shibuya et al.

together, and further use a semiconductor substrate, since Eguchi teaches that either glass or silicon is appropriate in such an application.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. (U.S. 5,298,761) in view of Shibuya et al. (U.S. 5,851,707) as applied to claim 1 above, and further in view of Wolf et al. (*Silicon Processing for the VLSI Era*, vol. 1).

Regarding claims 4 and 5, Aoki et al. and Shibuya et al. together teach the method of claim 1 (note 35 U.S.C. 103(a) rejection above), but do not specify that the photoresist is either positive or negative photoresist.

Wolf et al. teaches that positive or negative photoresist is appropriate to use in optical lithography (page 408, paragraph 2).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to perform the photolithography methods taught by Aiko et al. and Shibuya et al. together, using either positive or negative photoresist, as taught by Wolf et al. The motivation for using positive photoresist would be that it has higher resolution capabilities than negative photoresist, as expressly taught by Wolf et al. (page 408, paragraph 2). The motivation for using negative photoresist would be that it is less costly than positive photoresist, as expressly taught by Wolf et al. (page 420, second full paragraph).

Response to Arguments

Applicant's arguments filed 3/13/2006 have been fully considered but they are not persuasive.

Regarding claim 1 and the combination of Aoki et al. and Shibuya et al., Applicant argues that Shibuya et al. teaches achieving the same photoexposure conditions for singly-exposed photoresist areas using one mask and multiple-exposure photoresist areas using several masks (paragraph bridging pages 15-16). However, Shibuya et al. is relied upon for the teachings in the background section, as detailed in the rejection above, that simply indicate that there are advantages to exposing different sub-patterns in a resist layer to different exposure conditions. Since Aoki et al. teaches forming using multiple masks to expose multiple, non-overlapping areas in a layer of photoresist, given the teachings of Shibuya et al., one of ordinary skill in the art would find it obvious to use different exposure conditions to expose different sub-patterns with different masks.

Moreover, the word "photoexposure" is taken to be interchangeable with "exposure," since in the context of the instant application and the cited prior art, the exposures are all done with photons and therefore are "photoexposures."

Finally, regarding Applicant's amendment to the claim preamble, Aoki et al. teaches a method of eliminating stitching errors, which is a manner of achieving optimal photoexposure conditions. Exposing a pattern in the wrong position is certainly a suboptimal photoexposure condition.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather A. Doty, whose telephone number is 571-272-8429. The examiner can normally be reached on M-F, 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 571-272-1702. The fax number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

had


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800